

# Data Recording Protocols for Invasive Species Management (Inventory and Mapping)

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## I. Introduction

The prevention, control, and eradication of invasive species (including regulated noxious weeds) have become a critical component of the resource stewardship responsibilities of the USDA Forest Service. As we employ a variety of integrated management techniques against these invaders of terrestrial and aquatic systems, we utilize many kinds of information on the location, magnitude, and rate of spread of infestations. To achieve this need, we implement a variety of widely-accepted survey and inventory techniques to systematically collect statistically-valid infestation and population data. The techniques and procedures used to survey, inventory, and map infestations or populations of invasive species can be site-specific or species-specific.

These data recording protocols provide a standardized approach for the recording of invasive species survey, inventory, and mapping information collected in the field. The database of record for terrestrial and aquatic invasive species infestation survey and inventory data, and associated maps, is NRIS. Invasive species survey and inventory data in NRIS will interface with invasive species treatment data in the FACTS application through I-Web.

For the purposes of these data recording protocols, the term “invasive species” refers to any species of exotic plant, vertebrate, invertebrate or pathogen meeting the Executive Order 13112 definition of “invasive species”, including plant species defined by State or Federal statute as “noxious weeds”.

The Forest Service has adopted the International Data Standards for the Inventory, Mapping and Monitoring Invasive Plants<sup>1</sup>. The International Data Standards were designed to be compatible with existing inventory protocols such as the Montana Mapping Strategy<sup>2</sup> and the mapping system described in the Guidelines for the Coordinated Management of Noxious Weeds<sup>3</sup>. These data recording protocols incorporate the key aspects of those standards and additionally expands them to standardize basic inventory data collected for vertebrates, invertebrates, and pathogens.

Invasive species infestations cross-jurisdictional boundaries and are seldom managed in isolation. A cornerstone of invasive species management is cooperation and coordination with adjacent land ownerships and jurisdictions. This cooperation requires that information on the location and distribution of invasive species be shared. These protocols standardize information recording and mapping standards, facilitates information sharing between cooperators, aids in the early detection of new invasive species populations, and meets National Forest System invasive species program reporting requirements. Some of the data elements required by these protocols may be optional for Forest Service use, but if used, can facilitate data sharing with other entities.

These protocols are based on single species inventory where the target species has been identified as an invasive organism on the project site. The protocol includes parameters such as location, infestation size, and site information. The protocol focuses on presence, location, extent, abundance, and other characteristics of the infestation. When repeated observations of the infestation are made, noting relative changes in location, extent, other quantitative information, these activities are also considered to be inventories, but are temporally

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<sup>1</sup> International Data Standards for Inventory, Monitoring and Mapping Standards of Invasive Plants. 2001.NAWMA

<sup>2</sup> Cooksey, D.; R.Sheley. 1998. Mapping Noxious Weeds in Montana. Montana State University, extension. Bozeman, Montana

<sup>3</sup> Guidelines to Coordinated Management of Noxious Weeds - Development of Weed Management Areas”, formerly The Guidelines for Coordinated Management of Noxious Weeds in the Greater Yellowstone Area. 1999.

distinguished from the initial inventory of the infestation recorded in the database and site identification numbers will correlate. Additional infestation information (such as treatment and treatment efficacy) may be collected depending on the needs of the project and should be recorded in the appropriate database.

### Areas of Use

This protocol is applicable to both aquatic and terrestrial invasive species and applies to across all landscapes, ownerships, and ecosystems. The data recorded using these protocols will be a key source of information for reporting invasive species population or infestation levels, invasive species management planning, impact analyses and risk assessments, and management (treatment) efficacy. In addition, by using universally accepted data recording protocols, information can be shared with a variety of public and private organizations conducting invasive species management.

### Equipment

These protocols are designed to be used with Forest Service corporate data management applications, specifically the TESP-IS Application, and will work on all computer hardware and associated peripherals capable of operating with the corporate data management applications. Data collection hardware, such as Global Position System (GPS) devices, desktop computers, and/or portable data recorders (PDR), etc can be helpful for efficiently collecting and entering data into the corporate applications (NRIS or FACTS), locating and relocating infestation sites, and automating electronic data transfer.

### Training for Using The NRIS Application and These Protocols

Examiners must have basic knowledgeable in invasive species identification, basic mapping skills and the ability to estimate canopy cover of weed infestations.

### Invasive Species Management Performance

Invasive species survey and inventory activities are typically a key component of a successful invasive species management program. In some cases, a substantial amount of agency resources are expended on surveying for and inventorying invasive species infestations in order to identify the level of threat, set management priorities, communicate with the public, and develop sound integrated strategic plans.

At the national level, invasive species management success is not measured by the amount of pre-treatment survey and inventory work being completed, and thus there are no associated national performance measures. However as previously mentioned the inventory is a critical element in quantifying threat levels and establishing the foundation for an integrated treatment program.

The national invasive species program performance measures are as follows:

**Output** *Number of priority acres treated against invasive species*

The total number of priority acres treated is based on the annual program capabilities. Risk assessments and other scientific methods and systems are used to identify priority acres for treatment in a project plan. Priority acres treated are a subset of the Demand. Program outputs (acres treated) are reported annually.

**Output** *Number of priority acres monitored for treatment efficacy*

The acres monitored are based on the level of post treatment efficacy evaluation in relation to the total number of priority acres treated.

**Outcome** *Percentage (%) of priority acres successfully restored against targeted invasive species.*

The percentage of priority acres successfully restored is based on the objectives within a project plan – where the targeted species defined in the project plan were prevented, controlled, or eradicated on the priority acres identified in the plan. The program outcome is a long-term (5 - 10 yrs) measure of program performance. This long term program performance will be calculated from data collected annually that describes annual treatment efficacy.

**Efficiency** *Cost per priority acre restored.*

## II. Invasive Species Inventory Data Elements

The application workflow is driven by site and infestation attributes for a particular target invasive species. These attributes are supported by the guidance of this protocol and by the NRIS application. The required, optional, and auto-populated data elements (or data fields) are identified in this protocol and include instructions for properly recording specific data about the infestation. Although there are several optional data elements, (such as soil characteristics, existing vegetation community type and/or associated species, potential vegetation types, aspect, slope and elevation, etc.) completing these fields is encouraged and can be useful information for project management.

Data elements that have a standard “List of Values” (**LOV**) associated with them are listed as well. Data elements are grouped to follow the general layout and naming convention used in the NRIS application and specific values for each LOV are listed in the appendices. Invasive species survey and inventory data collection forms for use in the field are also available in the appendices. These field forms may be modified to fit local needs.

## Inventory Site Data Elements

**Examiner's Last, First Name:**      *Required*      *LOV*

The person that collected the data, enter last and first name from the list of values. The middle initial is optional. To add an examiner, click on the "Manage Examiners" button, a window will appear, add examiners name. Close the window to exit out of the screen to continue.

**Ownership:**      *Required*      *LOV*

Record the landownership where the site is located. In the case of multiple ownerships, record the landownership where the preponderance of the infestation or population is located.

**Proclaimed Unit:**      *Required*      *LOV*

Record the proclaimed National Forest/National Grassland number and name when the infestation is located on National Forest System Lands.

**Project Name:**      *Optional*      *LOV*

Record a project name code. A project is a grouping of multiple data sites related by a specific purpose. Multiple sites can be within the same project name. A project name is a useful way to group sites. The project name code is selected from a drop down menu that was created by a data steward in Terra projects form.

**Survey:**      *Optional*      *LOV*

Where a survey record has been created that discovered the invasive species population or infestation, the survey ID can be recorded. This is an optional field. This field provides a method of linking the detected invasive species population or infestation with the survey.

## Infestation Data Elements

**Infestation ID:**      *Required*

Infestation\_ID is a 30-digit alpha-numeric code that uniquely identifies the invasive species infestation. Although no national convention for this field is mandated, national direction recommends that the region, forest and district form the beginning of the *Infestation\_ID*. Using this convention will allow the easy sorting of information and uniquely identify infestations.

**Date:**      *Required*

Record the calendar month, day, and year the infestation was found or remeasured. This is the day that the information was collected in the field, *not* the date the data was entered into the database. The format is MMDDYYYY.

**Species Category:**      *Required*      *LOV*

The general life form of the detected Invasive Species, selected from the LOV. This field allows for the categorization of the target species and is used to reduce the species code list when selecting a species code in the following Species Code field.

Species Category
Plant
Pathogen
Vertebrate
Invertebrate

**Species Code:** *Required LOV*

Enter the accepted Species Code for the target species from the **LOV**. The Target Species Code is available based on the category selected from Species Category Field.

**Scientific Name:** *Auto-populated*

This refers to the latin, scientific name for the invasive species. This field will auto populate when the Target Species Code is entered.

**Common Name:** *Auto-populated*

This refers to the common or colloquial name, if any, for the target invasive species. This field will auto populate when the Target Species Code is entered.

**Total Area** *Auto-populated.*

Total Area is calculated from the area of the spatial feature. Total Area is an area, in acres, occupied by an invasive species delineated by a polygon that may represent the general area where the population is found or may represent the spatial extent of the infestation or population. *Total Area* may contain significant areas that are *not* within the perimeter of the target invasive species infestation in which case “% Infested” would be less than 100%.

**% Infested:** *Required*

Percent (%) Infested is the proportion of the Total Area (created spatial feature) that is infested with the target invasive species. The application will default *% Infested* to 100. In other words the application will assume that the spatial feature that represents the infestation is 100% infested. If the spatial feature represents a large area that contains significant area that is *not* within the perimeter of the target invasive species infestation, enter a percent that approximates the proportion that is actually infested based on the definition of “Infested Area”. A “0” may be used to document an infestation that currently contains no target species, during a re-measurement.

**Infested Area:** *Auto-populated*

Infested Area is defined as the area of land, in acres, containing a single invasive species delineated by the actual perimeter of the infestation or population as defined by the outer edge of the canopy cover of the plants or the visible population of other taxa, excluding adjacent areas not infested and outside the perimeter of the population. Areas containing only occasional invasive plants per acre do not equal one acre infested. Generally, the smallest area of infestation mapped is 1/10,000th (.0001 acre or 4.4 sqft) of an acre. This field is the product of Total Area multiplied by the % Infested.

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**Discussion:** The combination of Total Area and % Infested is a critical component of this methodology and will be used to monitor changes in infestation size, summarize acres of invasive species and share information on invasive species with cooperators, counties, states, federal agencies and other entities.

Infested Area is a calculated estimate of the actual extent or size of the infestation. The *Infested Area* field will be used to answer the question “How many acres of spotted knapweed are there on the National Forest?” The results will be generated from summing all the *Infested Area* fields for records (*Infestation\_IDs*) where spotted knapweed is found.

Some infestations are very large or discontinuous and it is difficult or not useful to delineate the actual perimeter of the infestation or population. The increase in accuracy gained by plotting a specific area of an individual population may not compensate for the increase in cost or manpower. The general spatial area on the landscape and an estimate of area infested may be sufficient to meet management requirements. *In these situations* the delineated spatial feature is assumed to include more area than the actual perimeter of an invasive population or infestation and % Infested would be less than 100.

**Example:** A large spotted knapweed infestation is located in the West Fork drainage. By driving around the area and looking at aerial photos the weed infestation is contained within an approximately 600 acre *area*. There are significant portions of the general area outside the perimeter of the knapweed infestation. It is estimated that approximately 40% of the delineated area is actually within the perimeter of infestation. The value in *Total Area* is 600 generated from the area of the spatial feature and the *% Infested is 40*. Infested Area would be calculated by 600 acres X 40% = 240 acres. In this case there was no added value or utility in mapping the smaller infestation within the larger area of 600 acres.

An infestation of scattered yellow starthistle with 5% canopy cover is found on a site. If a 2 acre polygon is created following the outer perimeter of the infestation, the *%Infested* would be 100% even though the population’s canopy cover was estimated at 5%.

*The following data elements allow users to collect optional descriptive data related to the target species at the time of inventory. The optional fields can be used to create qualitative and quantitative baseline assessment of the infestation or population for later evaluations.*

**Density:     Optional**

Density is the number of individuals of a target species per specified unit of measure.

**Density UOM:     Optional. LOV**

The Unit of Measure for density.

<b>UOM</b>	<b>Description</b>
Acres	Acres
SqFt	Square Foot
SqM	Square Meter
SqMi	Square Mile

**Count:     Optional.**

Count is the total number of individuals (i.e. number of animals, stems, or plants, etc) across the population or infestation. This is an optional field and may be useful for small infestations or populations with a limited number of individuals occupying an area.

**Count UOM:     Optional. LOV**

The Unit of Measure of the total count.

COUNT UOM
Stem
Plant
Individuals

## Canopy Cover

Ocular estimates of canopy cover of live foliage for invasive plants are an effective way to quickly collect abundance information about the species. Cover is a meaningful attribute for nearly all plant life forms, which allows their abundances to be evaluated in comparable terms (Daubenmire 1968, Mueller-Dombois and Ellenberg 1974). **Canopy cover** is “the percentage of ground covered by a vertical projection of the outermost perimeter of the natural spread of foliage of plants, small openings within the canopy are included” (SRM 1989, NRCS 1997). Canopy cover is synonymous with canopy closure (Helms 1998). For woody plants, canopy cover is synonymous with crown cover (NRCS 1997, Helms 1998).

The estimate of canopy cover is in relation to the Infested portions of the delineated spatial feature. Cover values are estimated and recorded for the Infested Area (e.g., these values need *not* be recorded using plot or transect based methods). The purpose for entering cover values is simply to provide relative estimates to compare the abundance of plant species. As such, these cover values would *not* be appropriate for more rigorous quantitative analyses of vegetation data.

### **Canopy Cover Set:**    *Optional*    **LOV**

The name of the cover class set you are using to describe canopy cover. Only three classes, Daubemire (6 Point), Ten Point Cover Class or the Greater Yellowstone Area are available.

### **Cover Class Code:**    *Optional*    **LOV**

The percent of a fixed area occupied by the plant species, life form, or ground cover type. Percent cover is obtained by projecting the outline of the foliage or surface feature to a horizontal plane and determining what percent of the fixed area it covers. This field is used for measured or estimated percent cover. Some measurement of canopy cover is required but this information can be entered in this field or by cover classes.

### **Cover Percent:**    *Optional*

Canopy cover is the percent of the ground, covered by foliage of a particular weed species. Percent cover is obtained by projecting the outline of the foliage or surface feature to a horizontal plane and then determining what percent of the fixed areas covered. This field is used to measure or estimate percent cover. In some cases canopy cover could exceed 100% when multiple layers of weed plants are present such as plants in the rosette and mature stages.

### **Life Stage:**    *Optional*    **LOV**

The predominant life stage of the target invasive species other than plants at the time of inventory or survey. In cases where there are un-definable mixtures of adult and juveniles in the population, the examiner has discretionary privilege to make the determination. This field should be used for invasive species taxa other than plants. See Appendix A for a List of Values (LOV).

### **Phenology:**    *Optional*    **LOV**

The predominant life stage of the target invasive plant at the time of inventory or survey. In cases where there are un-definable mixtures of flowering and vegetative stages in the infestation, the examiner has discretionary privilege to make the determination. This field only applies to invasive plants.

### **Distribution:**    *Optional*    **LOV**

The spatial arrangement of individual invasive species across the infestation or population at the time of inventory or survey. Select from the LOV. See Appendix A for a List of Values.

### **Life Form:**    *Optional*    **LOV**

Lifeform is defined as the characteristic form or appearance of a plant species at maturity. See Appendix A for a List of Values. This field only applies to invasive plants.

**Plant Status:**      *Optional*      *LOV*

This field provides the status code and set name for the specified invasive plant. Plant Status Code is a locally created list of values used to identify the status of the target weed such as state or county designated noxious or locally invasive or exotic weeds. The plant status is attached to individual species records defined in the default

invasive plant list. The field is not limited to officially designated status, it could contain rankings generated by a cooperative weed management area, forest, or district. Coding conventions for this field can be entered into the database by NRIS Terra Plants Editor. Codes can be from one to five characters in length and can be either numbers, characters or a combination of both. There is no limit to the number of *Plant Status\_Sets* for a region, forest or district. Following is an example of possible codes set.

Code	Description
NO	State Designated Noxious Weed
IN	Invasive Weed
EX	Non-Native plant

**Management Priority:**      *Optional.*      *LOV*

Management Priority refers to the relative importance of an invasive species to management actions. In some cases it may refer to a state designed priority category such as category A, B or C weeds. It could also be used to identify priorities for a Weed Management Area, county and environmental analysis. The field is populated from a locally stewarded List of Values. Codes and definitions will be developed locally, with the agreed to coding conventions entered into the database by the local NRIS data base steward. Following is an example of sample codes.

Priority	Description
PR1	Eradicate New Invaders
PR2	Eliminate Satellite Outbreaks
PR3	Control Established Invaders

***Site and Management Area Descriptions (Morphometry)***

**Elevation:**      *Optional*

For the spatial extent of the infestation, record the **Average** (or a “predominant”) elevation of the land surface occupied by the species as measured in meters or feet from the average of the mean high and mean low tide.

**Minimum** and **Maximum** elevation may be recorded if it is determined that the elevation range is significant for that particular infestation (e.g., on a steep slope or a large occurrence on an undulating landscape). The units of measure (UOM) will be feet or meters. Feet will be the default.

**Aspect:**      *Optional*

Direction in which a slope faces, measured in degrees of azimuth or cardinal direction. Record the predominant aspect as measured in the field that is characteristic of the site on which the infestation or population occurs. Either azimuth in degrees (preferred) or cardinal direction can be used.

**Azimuth:** (Range 0-360). The direction that the slope predominantly faces at a defined point of the infestation, such as the center point. Azimuth is recorded in degrees from north, in a clockwise manner. Use “360” for north. Use “0” when there is no slope.

**Cardinal:**      *LOV*. The generalized cardinal direction that the landscape predominantly faces at a defined position, such as the center point of the infestation. (Accuracy Standard: ± 11.25 degrees). See Appendix A for a List of Values.

**Percent Slope**    *Optional*

Record the ratio of vertical rise to horizontal distance for the site expressed as percent, taken at an average point on the site, or as an average for a site.

**Slope Position:**    *Optional*    *LOV*

A description of the two dimensional position on the slope profile of the landform. Record the position of the infestation on the landform as observed in the field.

## ***Management Areas***

**Allotment (RMU) Number and Allotment Name:**    *Optional*    *LOV*

Record the Allotment number (RMU= Range Management Unit) and name where the site is located. These numbers are the same as the RMU identifiers found in INFRA.

**Pasture (Sub RMU) Number and Pasture Name:**    *Optional*    *LOV*

Record the Pasture number and name where the site is located. (Sub RMU= Sub Range Management Unit) These numbers are the same as the Sub RMU identifiers found in INFRA.

**Key Area Number and Name:**    *Optional*    *LOV*

Record the local Key Area number and Key Area name where the site is located. These values also are found in INFRA.

**Area Number and Area Name:**    *Optional*

Record the Area number and Area name where the site is located. This is a set of locally defined values.

**Watershed HUC # and HUC Name:**    *Conditionally Required*    *LOV*

Record at least the 4<sup>th</sup> order Watershed HUC number and name where the site is located (Required only for aquatic invasive species).

## ***Additional Site Conditions (vegetation, water conditions, soils, etc)***

Existing Vegetation classifications provide context regarding the seral stage or current plant community in which the invasive species occurs and may be recorded whenever possible.

**Plant Community:**    *Optional*

The class set name, class code and class name associated with a given community type. The assemblage of plants occurring together at any point in time, thus denoting no particular successional status. A unit of vegetation.

**SAF Cover Type:**    *Optional*    *LOV*

Enter the code for the SAF cover type and the name of the SAF cover type.

**SRM Cover Type:**    *Optional*    *LOV*

Enter the code for the SRM cover types and the name of the SRM cover type. The kind of existing plant community with distinguishable characteristics described in terms of present or existing vegetation that dominates the aspect or physiognomy.

**Dominant Life Form:**    *Optional*    *LOV*

Dominant life form is defined as the characteristic form or appearance of the most common plant found on the site. Select from the list-of-values (LOV).

**Dominant and Co-Dominant Species**

Enter the dominant and co-dominant plant species; the species that occurs the most frequently on the site. Enter the dominant species plant code from the NRCS PLANTS database, and its scientific name will auto-populate. Enter

the two or three co-dominant species by order of occurrence from most to least. Enter the co-dominant species code from the NRCS PLANTS database.

**Plant Code:**            *Optional*            *LOV*

For vascular plant species, use the (most codes are less than 8 chars long) alpha-numeric code from the NRCS PLANTS data base.

**Scientific Name:**    *Auto-populated*

This refers to the latin, scientific name for the Dominant or Co-dominant plant. This field will auto populate when the Plant Code is entered.

**Soil Name**            *Optional*            *LOV*

The dominant soil map unit or soil series as indicated on a soils or ecological unit inventory map. Refer to locally stewarded soil maps or GIS layers to obtain this information.

**Soil Level**            *Auto-populate*

The class level of the soil as in appears in the soil classification. This field will auto-populate when Soil Name is entered.

**Soil Texture**            *Optional*            *LOV*

Soil texture is the proportions of the various size groups of individual mineral soil grains less than two millimeters equivalent diameter in a mass of soil, expressed as a class measured at the surface horizon.

**Landform Code and Landform Description**    *Optional*            *LOV*

The landform that commonly occurs as components of a variety of larger landforms and represents the "common usage" or "generic" terms such as mound, knob, or bench. Enter the common landform which best describes the general geomorphology of the site from the List of Values. See Appendix A for a List of Values and definitions.

**Primary and Secondary Lithology for Geology and Parent Material**    *Optional*

The corporate standard for Geology/Parent Material includes both a primary lithology and secondary lithology.

**Primary lithology:**            *LOV*

includes sedimentary, metamorphic, igneous intrusive, igneous extrusive, unconsolidated and undifferentiated.

**Secondary lithology:**            *LOV*

would include the more specific lithology such as sandstone, limestone, and alluvium. To get a full list of Primary and Secondary lithology codes and descriptions, refer to [Appendix U](#) in the back of the field guide.

**Mean Annual Precipitation**            *Optional*

Enter the mean annual precipitation for the area in which the site is located. Unit of measure for precipitation is inches or centimeters

***Potential Vegetation on Site***

**Range Site Class Code and Class Name**      *Optional*      *LOV*

Enter the class code and class name for the rangeland ecological site or ecological classification. The name of the ecological classification such as, “Ecological Land Unit Inventory” or “NRCS Range Site Classification”, or any other classification used to describe existing rangeland vegetation. These classifications are generally local in description and applicability.

**Habitat Type Code and Habitat Type Name**      *Optional*      *LOV*

The code associated with a habitat type. These codes are for regionally stewarded PNV habitat classification codes. The collective area which one plant association occupies or will come to occupy as succession advances.

**Habitat Type Phase Code and Habitat Type Phase Name**      *Optional*      *LOV*

The code associated with a habitat type phase. These codes are for regionally stewarded PNV habitat phase classification codes. A land area that supports, or has the potential of supporting, the same primary climax vegetation.

**Plant Association Code and Plant Association Name**      *Optional*      *LOV*

A kind of plant community consisting of stands with essentially the same dominant species in corresponding layers. This term has been applied to both existing and potential plant communities. These plant associations are most often defined at the local level. Documentation should identify whether these are potential or existing plant communities. Any NVCS defined association refer to existing plant communities.

**Seral Stage**      *Optional*

Refers to desired stages of ecological succession associated with climax communities.

**Ecological Status**      *Optional*

Ecological Status refers to the degree of similarity between the present vegetation community and the potential natural community of a site, expressed as a percent of potential. The basic premise to determining ecological status requires a completed classification. Ecological status would be a range from 0-100%, as determined by the percentage of the present vegetation compared to the potential community.

**Ecological Map Unit Code and Unit Name**      *Optional*

Enter the code and name for the Ecological Map Unit for the described cover types. (Local map unit or classification.)

**Ecological Type Code and Ecological Type Name**      *Optional*

Enter the code and name for the Ecological Type for the described cover types.

***Distance to Water***

**Horizontal Distance to Water:**      *Optional.*

Enter the measured or estimated distance to water. The distance is measured as a direct line from the edge of the infestation to the nearest surface water. This is often described “as the crow flies”. It is often useful to separate sites by the distance to water. This information is helpful in grouping or classifying weed sites into management or treatment zones. Conversely this field could be used to group sites where it is highly unlikely or improbable that herbicides could enter the water. Groupings based on distance to water can be useful for environmental analysis and discussions of potential effects within NEPA. The units of measure (UOM) will be feet or meters. Feet will be the default.

**Vertical Distance to Water:**      *Optional.*

Enter the estimated vertical distance from the surface to subsurface water directly below. Distance is measured in a direct line from the site of the infestation to the nearest subsurface water. This is useful information in grouping or classifying weed sites into management or treatment zones. It would identify areas where it is likely or possible that

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water movement through the soil profile could result in herbicides entering groundwater or other subsurface water systems. Conversely it could be used for grouping sites where it is highly unlikely or improbable that herbicides could enter groundwater systems. The units of measure (UOM) will be feet or meters. Feet will be the default.

**Remarks:** *Optional*

Narrative field to allow additional information on the characteristics of the target invasive species at the time of survey or inventory.

## Associated Species

An Associated Species is defined as any plant (or other) species that occurs, is associated with or commonly found growing or living on the site with the target invasive species. Associated species are those found in the same habitat and same location and should not include species that are not directly within or related to the polygon or site.

There is no limit to the number of species that may be entered. The NRIS INPA application will auto-populate the entire scientific name when plant codes are entered, and can auto-populate the NRCS plant code when the scientific name is chosen from the standard list.

**Species Code:** *Optional.* *LOV*

For vascular plant species, use the alpha-numeric code from the NRCS PLANTS data base. Identify plants to species and subspecies, if possible. For genus identification, enter the appropriate genus code, and enter subspecies code.

**Scientific Name:** *Auto-populated*

This refers to the latin, scientific name for the plant growing in association with the target invasive weed. This field will auto populate when the Plant Code is entered.

**Comment Field:** *Optional*

This field is available to the user to enter any relevant information on the weed infestation or characteristics of the site not covered by the site and setting fields.

## Infestation Spatial Features

This protocol requires spatially locating and delineating each invasive species infestation or population as polygons. Each polygon represents a single invasive species infestation or population which may overlap.

Spatial representation can be created by a number of methods:

- Hand-drawing the perimeter of the infestation on maps or aerial photos, then redrawing the feature within the TESP-IS Application;
- Using a GPS (Global Positioning System) device to define smaller areas, converting them to a shapefile, and importing the file;
- Digitizing the occurrence with a computerized mapping system (Geographic Information System [GIS]) and importing it.
- Using a combination of PDR software and ArcPad to create a polygon which is loaded directly into the NRIS ISA application.

Regardless of the method used to delineate an Infestation in the field, the protocol requires that the polygon be digitized and stored in ArcMap format. The spatial feature in NRIS will activate the tabular attribute screens.

To ensure consistency, the scale for hand-drawn occurrences on maps should be 1:24,000. This is the scale of United States Geological Survey (USGS) 7.5-minute quadrangle (quad) maps. Note that maps with a variety of scales are utilized in Alaska. (*Note: the 1:24,000 scale is also the standard for invasive plant mapping as recommended by the International Mapping Standards for Invasive Plants*). Aerial photos, orthophoto quads and remote sensing approaches can also be useful formats for delineation.

The minimum size for a delineated polygon can be as small as 0.0001 acre (4.3 sq. ft.). A single infestation may be comprised of more than one polygon (Figure 1). For example, a single infestation may be defined by clumps or patches of the same population in close proximity. Species and site tabular data such as % Infested, Cover, Density, and Count would apply to the *entire* infestation. Although each clump or patch can be individually drawn, acres for all the polygons are combined to calculate and auto-populate the Total Area in the NRIS application. Text notes about specific patches can be recorded and stored in the comments field.



**Figure 1:** A single invasive plant infestation represented by a multi-part polygon.

Geopolitical data such as State, County, Region, Forest and District will be derived from the location of the spatial feature. Tabular location fields beyond those mentioned above are provided in the field form and in the application, but are ***OPTIONAL***. These fields can be used to record a representative point or area for the location of the infestation, when desired. Tabular data can be recorded for quad maps or any of the four location methods described below.

- Legal description
- Latitude and Longitude
- GPS UTM location
- Metes and Bounds

### *Aerial Photo Information*

**Photo Label:**            *Optional*

Describes a particular photo.

**Aerial Photo Set, Photo Number, Flight line code, and Photo date/time**            *Optional*

A group of fields that describes a particular set of photos, with a photo number, flight line code, and date and time photo set was taken.

**Photo Number, Film Type, File Name, and File Directory**            *Optional*

Describes a particular photo, with a photo number , type of film used, the computer path name to locate the file name where the photo is stored, and the directory, i.e., URL, Web Site, or server in which the photo is located..

### *Image Information*

**Image ID:**            *Optional*

Text field used to denote related photograph exposure numbers or computer file designations.

**Image Description(s):**    *Optional*

Text field used to describe the subject of any photograph or electronic image taken.

## **Geopolitical Information**

In addition to storing the spatial representation of the invasive weed infestation, the NRIS INPA Inventory application will automatically derive and populate required tabular geopolitical fields (State, County, Region, Forest and District) based on the location of the spatial feature in the NRIS application. However, it can be useful to record the political or administrative units on the field form. An infestation may span two or more geopolitical units for any particular field. For example, an infestation may extend across a state, county or National Forest boundary. In this case, record all that apply.

**State:**            *Optional*

Record the code for the state in which the site is located. State will be auto-populated in the application when the spatial feature is created. These codes are the same as postal codes.

**County:**            *Optional*

Record the FIPS Codes for the county in which the site is located. County will be auto-populated in the application when the spatial feature is created.

**Region:**            *Optional*

Record the Region where the site is located, regardless of which Region is currently administering the site. Region will be auto-populated in the application when the spatial feature is created

**National Forest/Grassland:**    *Optional*

Record the National Forest where the site is located. National Forest will be auto-populated in the application when the spatial feature is created

**District:**            *Optional*

Record the Ranger District number where the site is located. District will be auto-populated in the application when the spatial feature is created

## **Reference**

Include information in locating the starting point for the traverse leg and other important description information. Reference refers to the physical marking of a site, i.e., tree, stake, and could indicate the start of a transect, or a point from which to locate the transect.

### **Reference Azimuth:**

Record the azimuth to the plot center from the reference point.

### **Reference Distance:**

Record the distance to the site from the reference point. The unit of measure (UOM) would be in feet or meters.

### **Direction:**

Provide a detailed description of the location, direction to site and map location if applicable for the reference.

Traverse information for start point to sample point.

## **GPS Equipment Used:**

The manufacturer and model number of the GPS unit used.

## **USGS Quad Number:**

The number of the primary USGS quadrangle map containing the infestation or population. These codes are stewarded nationally by the ALP application. *(Note: only one representative quad can be entered in the NRIS application.)*

## **USGS Quad Name:**

The name of the primary USGS quadrangle map containing the infestation or population. These codes are stewarded nationally by the ALP application. *(Note: currently only one representative quad can be entered in the NRIS application.)*

## **Forest Quad Number:**

The locally stewarded number for the primary USGS quad map where the infestation or population is located. *(Note: currently only one representative quad can be entered in the NRIS application.)*

## **Forest Quad Name:**

The locally stewarded name for the primary USGS quad map where the infestation or population is located. *(Note: currently only one representative quad can be entered in the NRIS application.)*

## **Legal Description (Public Land Survey System PLSS)**

For areas of the country where the Public Land Survey System is available, it may be desirable to record this information to an appropriate level of detail **on the field form only**. Since legal descriptions will not be auto-populated in the NRIS application, this information must be manually entered into the NRIS INPA data entry form if it is desired to be electronically stored.

### **Meridian:**            *LOV*

Record the code for the line of longitude from north to south that is the basis for local legal descriptions. These lines are also known as Principal Meridians and have distinct names. This information is available on the USGS Quadrangle map.

**Township/Direction and Range/Direction** *LOV*

A Township is a unit of land containing 36 mile-square sections. Townships run in rows that parallel the local Base line. Each Township row is sequentially numbered relative to the row’s order from, and whether it’s north or south of, the local Base line; e.g., T2N (for the second township row north of the local Base line). To accommodate fractions of townships an additional code is required after the Township number, where 0 will equal no fraction; 1 equals ¼; 2 equals ½, and 3 equals a ¾ township (see table of examples below).

The Range numbers run parallel to the local Principal Meridian. Range rows are sequentially numbered relative to the row’s order from, and whether it’s east or west of, the Principal Meridian; e.g. R2E (for the second Range row east of the Principal Meridian).

This information is available on the USGS Quadrangle map. These codes are stewarded nationally by ALPS.

**Section:**

Each 36 square-mile township is subdivided into smaller squares called Sections. Record the Section where the center of the EO is located. A Section is equal to one square mile, 2.59 square kilometers, 640 acres, or 1/36 of a township. This information is available on the USGS Quadrangle map

**Quarter Section** *LOV*

Record the ¼ section subdivision where the infestation is located. For example: the NE quarter of section 4 (NE ¼)

**Quarter, Quarter Section** *LOV*

Record the ¼¼ section subdivision where the site is located. For example: the NW quarter of the NE quarter of Section 4 (NW ¼ NE ¼)

**Quarter, Quarter, Quarter Section** *LOV*

Record the ¼¼¼ section subdivision where the site is located. For example: the SE quarter of the NW quarter of the NE quarter of Section 4 (SE ¼ NW ¼ NE ¼).

**Quarter, Quarter, Quarter, Quarter Section** *LOV*

Record the ¼¼¼¼ section subdivision where the site is located. For example: the SW quarter of the SE quarter of the NW quarter of the NE quarter of Section 4 (SW ¼ SE ¼ NW ¼ NE ¼).

*Latitude and Longitude (Degrees, minutes, seconds)*

Arbitrary measurements used to describe any point on the Earth or similar globe. Borrowing from theories of ancient Babylonians, later expanded by the famous Greek thinker and geographer Ptolemy, a full circle is assigned 360 degrees. Latitude is the term for the distance from the middle of the circle, or, in the case of the Earth, the equator. The equator is designated 0 degrees, with each pole being 90 degrees. Longitude is the vertical measurement--current convention places the zero degree point at Greenwich, England (also known as the Prime Meridian), with 180 degrees being on the opposite point on the globe.

**Geodetic Datum:** *LOV*

Record the geodetic datum for the latitude and longitude coordinates. Latitude and longitude in degrees/minutes/seconds will be automatically converted to decimal degrees.

Examples of Datums	Description
WGS-84	World Geodetic System (1984)

**Latitude:**

**Degrees:** (Range 0 to 90) The latitude degrees of the center of the Infestation as measured by GPS.  
(Default: North Latitude).

**Minutes:** (Range 0 to 59) The latitude minutes of the center of the infestation as measured by GPS.  
(Default: North Latitude).

**Seconds:** (Range 0 to 59.99) The latitude seconds of the center of the infestation as measured by GPS.  
(Default: North Latitude)

**Longitude:**

**Degrees:** (Range 0 to 180) The longitude degrees of the center of the infestation as measured by GPS.  
(Default: West Longitude).

**Minutes:** (Range 0 to 59) The longitude minutes of the center of the infestation as measured by GPS.  
(Default: West Longitude).

**Seconds:** (Range 0 to 59.99) The longitude seconds of the center of the infestation as measured by GPS.  
(Default: West Longitude).

**GPS Geodetic Datum:** *LOV*

Record the geodetic datum used by the GPS unit for the Latitude and Longitude coordinates. See table above for examples of commonly used datums.

**Latitude Decimal Degree:**

Latitude in a degree value. Consists of the latitude in degrees to at least 6 decimal places.

**Longitude Decimal Degree:**

Longitude in a degree value. Consists of the longitude in degrees to at least 6 decimal places.

Longitude Example	Latitude Example	Description
105.105206	42.206088	Decimal degrees

**UTM Location:**

The Universal Transverse Mercator Map Projection. A special case of the Transverse Mercator project. Abbreviated as the UTM Grid it consists of 60 north-south zones, each 6 degrees wide in longitude.

**UTM Datum:** *LOV*

Record the datum for the UTM projection.

Examples of Datums	Description
<b>NAD-27</b>	North American Datum of 1927
<b>NAD-83</b>	North American Datum of 1983

**UTM Zone:** LOV

The zone for the UTM projection. This can be obtained from quad maps or from GPS devices. UTM zone coordinates measure in meters east and north from two perpendicular reference baselines. (Up to two alphanumeric characters.)

UTM Zone Example	Description
13	Ranges from 1 to 60

**Easting:** The distance in meters, east or west, from the central meridian of the UTM Zone, which is designated at a value of 500,000 meters.

**Northing:** The distance in meters north from the equator from the UTM Zone origin, which is designated as a value of zero meters. (This protocol addresses only north latitudes.)

Northing Example	Easting Example	Description
1687534000.25	71204000.52	Recorded to the hundredth of a meter.

**Metes and Bounds:**

Metes and bounds is a system or method of describing property or real estate when it is surveyed. The system was used in England and, by custom, was applied in the original 13 colonies that became the United States. The system uses physical features of the geography along with directions and distances to define a piece of land. It is sometimes referred to as a *Boundary Survey*. The NRIS Invasive Species Application accommodates text up to 2000 characters in length.

**Monitoring Invasive Species: Re-measurements**

Weed infestations can change dramatically over time. Weed populations can expand exponentially, spreading along roads and trails. Conversely, infestations can be reduced through treatment. Separate infestations can grow together to form a single, large infestation. An infestation can spread by forming separate subpopulations or patches where one previously existed.

An essential element of invasive plant management is observing changes (monitoring) in invasive species populations over time. This monitoring approach documents changes in invasive species populations or infestations through characteristics such as spatial expansion or contraction of a given infestation. Subsequent visit to a known site for re-measurement is considered ***infestation or population level monitoring***. This is not to be confused with effectiveness monitoring of management activities, which is addressed under the National **Data Recording Protocols for Invasive Species Management (Treatment and Treatment Monitoring)**

Each monitoring visit or re-measurement will require the completion of a new infestation polygon and tabular record to document the results. Repeated observations of the same infestation or population will be identified with the same *Infestation\_ID*, but differentiated by the visit date. Stable site characteristics and location information from the previous record can be copied to the new record within the application when appropriate. You can then update the copied information about the invasive species infestation or population. Changes in an infestation following treatment can be monitored through reduction in ***Canopy Cover, Count, Density, % Infested*** or reduction in spatial extent.

The *Infestation\_ID* must remain constant for a particular infestation through time. Changes in the spatial or tabular data (i.e. size, shape, plant abundance, distribution etc.) can be traced over time through subsequent monitoring, differentiated by the *Visit Date*.

There is no limit to the number of re-measurements.

### **Re-measuring an Expansion from a Single Perimeter**

An individual infestation can expand, contract or even move across the landscape. All observations are tied together by the *Site\_ID* and differentiated from each other by the date of the observation. For each observation make any needed adjustments to the information contained in the existing or parent record.

### **Expansion from Subpopulations/Patches or Split Infestations**

Infestations cannot only merge or spread across a single front but may also split into or spread as subpopulations or discrete patches. There are a number of factors that could lead to splits such as treating only part of an infestation. In this type of expansion, a single (“parent”) infestation changes to a multi-part infestation with discrete patches or subpopulations (“Children”). Many of the principles in polygon and *Infestation\_ID* management discussed in the previous paragraph are applicable. All observations are tied together by the *Infestation\_ID* and differentiated from each other by the date of the observation. In this situation the re-measurement would result in the creation of a multi-part polygon. Characterization of the infestation would be an estimated average across all the polygon parts.

### **Merging Infestations**

Two geographically separate invasive plant infestations can grow and expand overtime, merging into a single infestation. It is important to monitor and document this expansion over the landscape. The two “parent” sites with their *Infestation\_IDs* will merge into a single site with one *Infestation\_ID*. This new site is called the “child” and will retain the *Infestation\_ID* from one of the “parents”. All the previous sites and their relationships will be maintained. While there is no limit to the number of merges, the number of merged sites can be minimized by carefully drawing infestation boundaries and the understanding and use of multi-part polygons. If sites are relatively close and will soon grow together, consider mapping these adjacent sites as a single site, using multi-part polygons.

### **Eradicated Infestations**

All visual evidence of an infestation may disappear after treatment such as the application of herbicides. Though above ground the weed may have disappeared there may be roots, stems and other plant parts that may recover and sprout. Seeds are stored in the soil profile for many years and may remain viable for 15 years or longer. The relative time of monitoring visits compared to other years and/or yearly climate fluctuations may also affect the observations. For these reasons it is important to monitor sites for many years, even after all evidence of invasive plants has disappeared.

For re-measurements that turn up no visual evidence of the invasive plant, create a new, very small -polygon representing the current infestation with a *% Infested* as “0” (zero), copying the most recent site and species attributes. Entering a canopy cover, density and/or plant count of “0” (Zero) may also be useful to document no visual evidence of the target species. Enter appropriate notes or narrative in the “Comment” field. Recording a new re-measured polygon and related data in the interim allows for monitoring of the site until there is adequate evidence that the infestation has in fact been eradicated.

## Invasive Plants without a Crosswalk in the PLANTS database

NRIS uses codes from the PLANTS Database to enter plant information. NRIS will only allow a *Plant Code* to be entered. The application will not allow the user to enter a name in the *Genus*, *Species*, *Common Name* or any of the plant fields. Because of this constraint a plant code from the PLANTS Database must exist for a plant name to be entered. Sometimes a plant will be identified, where a code in the PLANTS Database does not yet exist. This can be the result of **new** taxonomy, **new** nomenclature and, in the case of invasive exotic species, **new** species to North America. It may take up to two years for a new species to be added to the PLANTS Database. This group of fields allow you to record and data base this information in the interim period until PLANTS establishes a code. This field will also be used by regional botanists to alert the PLANTS Database, that a new code is needed. To use these fields enter NO-XWALK in the *Plant Code* field and then select the Unidentified/New Plants tab. Do not use these fields for plants that you cannot identify. There are a number of fields that allow you codes for genera, family and life form. The follow fields should be entered from the Unidentified/New Plant Tab to extent possible if *Plant Code* is NO-XWALK.

**Common Name:**      *Optional*

These are the weed names most commonly used in conversation. They are often descriptive e.g., yellow star thistle.

**Genus:**              *Optional*

This refer to the scientific name for the Genera.

**Species:**            *Optional*

This refer to the scientific name for the species

**Subspecies:**      *Optional*

This field is reserved for finer delinations of species such as subspecies and refers to the scientific name for the subspecies.

**Variety:**            *Optional*

This field is reserved for finer delinations of species, the variety name.

**Authority:**        *Optional*

Enter the abbreviation for the name of the authority. The authority refers to first individual to classify the plant into this name.

**Collection Number:**      *Optional*

Enter the collection number from the specimen label. This field can be up to 20 charactrers in length and any combination of numbers and letters.

**Voucher Number:**      *Optional*

Enter the voucher number from the voucher label. This field can be up to six (6) characters in length and any combination of numbers and letters. The *Voucher\_Number* is usually assigned by the herbarium that verifies the identification.

**Remarks:**              *Optional*

This is a comment field. Enter any relevant information up to 240 characters in length.

## APPENDIX A - LIST OF VALUES (STANDARD CODES) FOR INVASIVE PLANT INVENTORY FIELD FORM

Following are the standard codes or List of Values used for this protocol. Additional values should not be added to these lists without National approval because they will not be able to be entered into the NRIS ISA application.

### *Ownership* List of Values

Code	Description
CGOV	County government
F&G	State fish and game department
USOT	U.S. Government (other federal lands)
MGOV	Municipal government
TRIB	Tribal
PRIV	Private
BLM	Bureau of Land Management
USFWS	U.S. Fish and Wildlife Service
USFS	U.S.D.A. Forest Service
BIA	Bureau of Indian Affairs
NPS	National Park Service
DOD	Department of Defense
STDL	Department of State Lands
OTH	Other
UNIV	University
TVA	Tennessee Valley Authority
N/A	Not Applicable
TNC	The Nature Conservancy

### *Canopy Cover Class Sets* List of Values:

Canopy Cover Set	Description
NRMCOV	Ten Point Cover Class
DAUBEN	Daubemire Cover Classes
GYA	Greater Yellowstone Area Cover Classes

### *Canopy Cover Class Values - Listed by Set*

#### Ten Point Cover Classes

Class Code	CoverClass	Mid Point
T	0-1.0%	0.5%
0	1.1-5.0%	3.0%
1	5.1-15.0%	10.0%
2	15.1-25.0%	20.0%
3	25.1-35.0%	30.0%
4	35.1-45.0%	40.0%
5	45.1-55.0%	50.0%

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6	55.1-65.0%	60.0%
7	65.1-75.0%	70.0%
8	75.1-85.0%	80.0%
9	85.1-95.0%	90.0%
A	91.1-99.0%	97.0%
X	99.1-100%	99.5%

**Daubenmire Classes**

Class Code	Cover Class	Mid Point
T	0 - 1.0%	0.5%
1	1.1 - 5.0%	3.0%
2	5.1 - 25.0%	15.0%
3	25.1 - 50.0%	37.5%
4	50.1 - 75.0%	62.5%
5	75.1 - 95.0%	85.0%
6	95.1 - 100%	97.5%

**Greater Yellowstone Area Cover Classes<sup>4</sup>**

**Guidelines for Coordinated Management of Noxious Weeds**

Cover Code Class	Cover	Mid Point
T – Trace	0-1%	0.5%
L – Low	1.1 – 5.0%	2.5%
M – Moderate	5.1 – 25%	15%
H- High	25.1 – 100%	63%

***Distribution List of Values:***

Code	Class	Description
Cl	Clumpy	
SP	Scattered Patchy	
SE	Scattered Even	
LI	Linear	

***Lifeform List of Values:***

Code	Name	Description
FB	Forb/herb	Vascular plant without significant woody tissue above or at the ground. Forbs and herbs may be annual, biennial, or perennial but always lack significant thickening by secondary woody growth and have perennating buds borne at or below the ground surface.
GR	Graminoid	Grass or grass-like plant, including grasses (Poaceae), sedges (Cyperaceae), rushes (Juncaceae), arrow-grasses (Juncaginaceae), and quillworts (Isoetes).
LC	Lichen	Organism generally recognized as a single plant that consists of a fungus and an alga or cyanobacterium living in symbiotic association. Often attached to solid objects such as rocks or living or dead wood rather than soil.
LI	Liana	Climbing plant found in forests with long, woody, rope-like stems of anomalous anatomical structure. A shrub in the FGDC classification.
NP	Nonvascular	Nonvascular, terrestrial green plant, including mosses, hornworts, and liverworts.

<sup>4</sup> Guidelines to Coordinated Management of Noxious Weeds - Development of Weed Management Areas”, formerly The Guidelines for Coordinated Management of Noxious Weeds in the Greater Yellowstone Area. 1999.

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<b>Code</b>	<b>Name</b>	<b>Description</b>
		Always herbaceous, and often attached to solid objects such as rocks or living or dead wood rather than soil.
SH	Shrub	Perennial, multi-stemmed woody plant that is usually less than 4 to 5 meters or 13 to 16 feet in height. Shrubs typically have several stems arising from or near the ground, but may be taller than 5 meters or single-stemmed under certain environmental conditions.
SS	Subshrub	Low-growing shrub usually under 0.5 m or 1.5 feet tall (never exceeding 1 meter or 3 feet tall) at maturity..
TR	Tree	Perennial, woody plant with a single stem (trunk), normally greater than 4 to 5 meters or 13 to 16 feet in height; under certain environmental conditions, some tree species may develop a multi-stemmed or short growth form (less than 4 meters or 13 feet in height).
UN	Unknown	Lifeform is unknown.
VI	Vine	Twining/climbing plant with relatively long stems, which can be woody or herbaceous..
AL	Algae	A general name for the single-celled plant plankton, seaweeds, and their freshwater allies.
FU	Fungi	A non-flowering plant of the kingdom Fungi, lacking chlorophyll.

***Phenology*** List of Values:

<b>Code</b>	<b>Description</b>
G1	Graminoids: Leaves partially developed; no heads
G2	Graminoids: Inflorescence inside the sheath (in the boot)
G3	Graminoids: Inflorescence partially or fully exerted from sheath
G4	Graminoids: Seeds maturing or mature
G5	Graminoids: Senescent; dormancy
F1	Forb-Shrub: Pre-flowering (vegetative, rosettes, and bolting)
F2	Forb-Shrub: Flowering
F3	Forb-Shrub: Fruiting
F4	Forb-Shrub: Senescent; dormancy

***Lifestage*** List of Values:

<b>Code</b>	<b>Description</b>
Adult	Sexually mature adult
Alates	Alates
C-1	First copepodite stage
C-2	Second copepodite stage
C-3	Third copepodite stage
C-4	Fourth copepodite stage
C-5	Fifth copepodite stage
Egg Mass	Mass of developing ova
Gemmule	Asexual reproduced stage
Glochid	Glochidia parasitic larval stage
Instar	Immature stages between molts
Instar-1	First Instar
Instar-2	Second Instar
Instar-3	Third Instar

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Instar-4	Fourth Instar
Instar-5	Fifth Instar
Instar-6	Sixth Instar
Instar-7	Seventh Instar
Instar-8	Eight Instar
Juvenile	Immature life stage
King	Adult King
Larva	Immature life stage
Larvae	Larvae
Medusa	Motile free swimming stage of Cnidaria
N-1	First Naupliar stage
N-2	Second Naupliar stage
N-3	Third Naupliar stage
N-4	Fourth Naupliar stage
N-5	Fifth Naupliar stage
N-6	Sixth Naupliar stage
Planula	Immature stage between medus
Polyp	Sessile stage of Cnidaria
Pupae	Pupae
Queen	Adult Queen
Statobla	Asexually produced capsule
Veliger	Nonparasitic larval stage
Worker	Workers and Soldiers
Zoid	Asexually morphological stage

***Slope Position List of Values:***

<b>Code</b>	<b>Name</b>	<b>Description</b>
BS	Backslope	The steepest portion of the slope where material is generally in transit.
FS	Footslope	The lower portion of the slope where material is generally re-deposited.
SH	Shoulder	The upper slope where material generally moves through creep processes.
SU	Summit	The uppermost slope.
TS	Toeslope	The lowermost slope position where material moves generally through alluvial processes.

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**Aspect: Cardinal Direction List of Values:**

Code	Name	Description
A	Includes all aspects	Where a population is on a conical depression or elevation and all aspects are represented
E	East	East
ENE	East northeast	East northeast
ESE	East southeast	East southeast
FL	Flat (no aspect)	Flat (no aspect)
N	North	North
NE	Northeast	Northeast
NNE	North northeast	North northeast
NNW	North northwest	North northwest
NW	Northwest	Northwest
S	South	South
SE	Southeast	Southeast
SSE	South southeast	South southeast
SSW	South southwest	South southwest
SW	Southwest	Southwest
W	West	West
WNW	West northwest	West northwest
WSW	West southwest	West southwest

**Soil Texture List of Values:**

Code	Name	Description
C	clay	A term used in the U.S. and by the International Society of Soil Science for a rock or mineral particle in the soil, having a diameter less than 0.002 mm (2 microns)
CL	clay loam	A soil containing 27-40% clay, 20-45% sand, and the remainder silt.
L	loam	A rich, permeable soil composed of a friable mixture of relatively equal and moderate proportions of clay, silt, and sand particles, and usually containing organic matter
S	sand	A term used in the U.S. for a rock or mineral particle in the soil, having a diameter in the range of 0.05-2 mm.
SI	silt	A rock or mineral particle in the soil, having a diameter in the range of 0.002-0.05 mm.
SIL	silt loam	A soil containing 50-88% silt, 0-27% clay, and 0-50% sand; e.g. one with at least 50% silt and 12-27% clay, or one with 50-88% silt and less than 12% clay.
SL	sandy loam	A soil containing 43-85% sand, 0-50% silt, and 0-20% clay, or containing at least 52% sand and no more than 20% clay and having the percentage of silt plus twice the percentage of clay exceeding 30, or containing 43-52% sand, less than 50% silt, and less than 7% clay.

## Common Landforms

**From:** *A Geomorphic Classification System, U.S.D.A. Forest Service, February 1998, Version 1.4*  
<http://fsweb.wo.fs.fed.us/mgm/>

**Common Landforms:** Landforms that commonly occur as components of a variety of larger landforms. These are landforms not clearly tied to a single Geomorphic Process Type or Landform. For instance, the Common Landform swale may occur on moraines, toe zones, eroding hillslopes, or alluvial fans. They represent terms that are "common usage" or "generic" such as mound, knob, or bench. Common Landforms should be used in conjunction with a process landform unless they are used to describe a site (point or plot) where the process and landform cannot be determined. For definition of these terms, refer to the glossary.

### Common Landforms List of Values (LOV)

Landform	Description
<b>Arroyo</b>	A term applied in the arid and semi-arid regions of the southwest U.S. to the small deep flat-floored channel or gully of an ephemeral stream or of an intermittent stream, usually with vertical or steeply cut banks of unconsolidated material at least 60 cm high; it is usually dry, but may be transformed into a temporary watercourse or short-lived torrent after heavy rainfall. (Bates and Jackson, 1995)
<b>Bald</b>	A local term, especially used in the southern U.S., for an elevated, grassy area, as a mountain top or high meadow, that is devoid of trees. (Bates and Jackson, 1995)
<b>Ballon</b>	A rounded, dome-shaped hill, formed either by erosion or by uplift. (Bates and Jackson, 1995)
<b>Bay</b>	(a) A wide, curving open indentation, recess, or arm of a sea or lake into the land or between two capes or headlands, larger than a cove, and usually smaller than, but of the same general character as, a gulf. (b) A large tract of water that penetrates into the land and around which the land forms a broad curve. By international agreement (for purposes of delimiting territorial waters), a bay is a water body having a baymouth less than 24 nautical miles wide and an area that is equal to or greater than the area of a semicircle whose diameter is equal to the width of the baymouth. (Bates and Jackson, 1995)
<b>Bayou</b>	(a) A term variously applied to many local water features in the lower Mississippi River basin and in the Gulf Coast region of the U.S., esp. Louisiana. Its general meaning is a creek or secondary watercourse that is tributary to another body of water; esp. a sluggish and stagnant stream that follows a winding course through alluvial lowlands, coastal swamps or river deltas. (b) An effluent branch, esp. sluggish or stagnant, of a main river, e.g., a distributary flowing through a delta. Also, the distributary channel that carries floodwater or affords a passage for tidal water through swamps or marshlands. (c) A bayou lake or an oxbow lake. (d) A slough in a salt marsh. (e) An estuarine creek (generally tidal), or an inlet, bay, or open cove on the Gulf Coast. (f) A term used in northern Arkansas and southern Missouri for a clear brook or rivulet. (Bates and Jackson, 1995)
<b>Bench</b>	A long, narrow, relatively level or gently inclined strip or platform of land, earth, or rock, bounded by steeper slopes above and below, and formed by differential erosion of rocks of varying resistance or by a change of base-level erosion; a small terrace or step like ledge breaking the continuity of a slope; an eroded bedrock surface between valley walls. The term sometimes denotes a form cut in solid rock as distinguished from one (as a terrace) cut in unconsolidated material. (Bates and Jackson, 1995)
<b>Blowout</b>	(a) A butte, the top of which has been blown out by the wind until it resembles a volcanic crater. (b) A shallow basin formed where vegetation has been destroyed by fire or by overgrazing. (Bates and Jackson, 1995)
<b>Bluff</b>	A high bank or bold headland with a broad, precipitous, sometimes rounded cliff face overlooking a plain or a body of water; esp. on the outside of a stream meander; a river bluff. (Bates and Jackson, 1995)

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<b>Break</b>	A marked variation of topography, or a tract of land distinct from adjacent land, or an irregular and rough piece of ground. (Bates and Jackson, 1995)
<b>Channel</b>	The bed where a natural body of surface water flows or may flow; a natural passageway or depression of perceptible extent containing continuously or periodically flowing water, or forming a connecting link between two bodies of water; a watercourse. (Bates and Jackson, 1995)
<b>Cliff</b>	Any high, very steep to perpendicular or overhanging face of rock; a precipice. A cliff is usually produced by erosion, less commonly by faulting. (Bates and Jackson, 1995)
<b>Depression</b>	Any relatively sunken part of the Earth's surface; esp. a low-lying area surrounded by higher ground and having no natural outlet for surface drainage, as an interior basin or a karstic sinkhole. (Bates and Jackson, 1995)
<b>Drainage</b>	A collective term for the streams, lakes, and other bodies of surface water by which a region is drained; a drainage system. (Bates and Jackson, 1995)
<b>Draw</b>	(a) A small natural watercourse or gully, generally more shallow or more open than a ravine or gorge; a shallow gulch; a valley or basin. (b) A usually dry stream bed; a coulee whose water results from periodic rainfall. (c) A sag or troughlike depression leading up from a valley to a gap between two hills. (Bates and Jackson, 1995)
<b>Escarpment</b>	A long, more or less continuous cliff or relatively steep slope facing in one general direction, breaking the continuity of the land by separating two level or gently sloping surfaces, and produced by erosion or by faulting. The term is often used synonymously with scarp, although escarpment is more often applied to a cliff formed by differential erosion. (Bates and Jackson, 1995)
<b>Faceted spur</b>	A spur or ridge with an inverted-V face that was produced by faulting or by the trimming, beveling, or truncating action of streams, waves, or glaciers. (Bates and Jackson, 1995)
<b>Flat</b>	A general term for a level or nearly level surface or small area of land marked by little or no relief, as a plain; specif: mud flat; valley flat. Also, a nearly level region that visibly displays lower relief than its surroundings. (Bates and Jackson, 1995)
<b>Floor</b>	(a) The bed of any body of water; esp. the continuous and gently curved or essentially horizontal surface of the ground beneath the water of a stream, lake, or ocean. (b) valley floor. (c) The bottom of a depression, such as the floor of a crater. (Modified from Bates and Jackson, 1995)
<b>Fluve</b>	A linear depression (topographic low) of any size, along which water flows at some time. (Peterson, 1981)
<b>Free face</b>	The part of a hillside surface consisting of an outcrop of bare rock (such as a scarp or cliff) that stands more steeply than the angle of repose of the constant slope immediately below. (Bates and Jackson, 1995)
<b>Gap</b>	A term used for a sharp break or opening in a mountain ridge, or for a short pass through a mountain range; e.g. a wind gap. (Bates and Jackson, 1995)
<b>Gorge</b>	A narrow, deep valley with nearly vertical rocky walls, enclosed by mountains, smaller than a canyon, and more steep-sided than a ravine; esp. a restricted, steep-walled part of a canyon. (Bates and Jackson, 1995)
<b>Gulch</b>	A term used esp. in the western U.S. for a narrow, deep ravine with steep sides, larger than a gully. (Bates and Jackson, 1995)
<b>Gully</b>	(a) A very small valley, such as a small ravine in a cliff face, or a long, narrow hollow or channel worn in earth or unconsolidated material (as on a hillside) by running water and through which water runs only after a rain or the melting of ice or snow; it is smaller than a gulch. (b) Any erosion channel so deep that it cannot be crossed by a wheeled vehicle or eliminated by plowing, esp. one excavated in soil on a bare slope. (c) A small, steep-sided wooded hollow. (Bates and Jackson, 1995)
<b>Hummock</b>	A rounded or conical knoll, mound, hillock, or other small elevation. Also, a slight rise of ground above a level surface. (Bates and Jackson, 1995)
<b>Interfluve</b>	The area between rivers; esp. the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. (Bates and Jackson, 1995)
<b>Knob</b>	(a) A rounded eminence, as a knoll, hillock, or small hill or mountain; esp. a prominent or isolated

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	hill with steep sides, commonly found in the southern U.S. (b) A peak or other projection from the top of a hill or mountain. Also, a boulder or group of boulders or an area of resistant rocks protruding from the side of a hill or mountain. (Bates and Jackson, 1995)
<b>Knoll</b>	(a) A small, low, rounded hill; a hillock or mound. (b) The rounded top of a hill or mountain. Bates and Jackson, 1995)
<b>Ledge</b>	(a) A narrow shelf or projection of rock, much longer than wide, formed on a rock wall or cliff face, as along a coast by differential wave erosion of softer rocks. (b) A rocky outcrop; solid rock. (c) An underwater ridge of rocks, esp. near the shore; also, a nearshore reef. (d) A quarry exposure or natural outcrop of a mineral deposit. (Bates and Jackson, 1995)
<b>Mound</b>	(a) A low rounded natural hill, generally of earth; a knoll. (b) A small man-made hill, composed either of debris accumulated during successive occupations of the site or of earth heaped up to mark a burial site. (Bates and Jackson, 1995)
<b>Mountain</b>	(a) Any part of the Earth's crust higher than a hill, sufficiently elevated above the surrounding land surface of which it forms a part to be considered worthy of a distinctive name, characterized by a restricted summit area (as distinguished from a plateau), and generally having comparatively steep sides and considerable bare-rock surface; it can occur as a single, isolated eminence, or in a group forming a long chain or range, and it may form by earth movements, erosion, or volcanic action. Generally, a mountain is considered to project at least 300 m above the surrounding land. (b) Any conspicuous or prominent elevation in an area of low relief, esp. one rising abruptly from the surrounding land and having a rounded base. (c) A region characterized by mountains; term usually used in the plural. (Bates and Jackson, 1995)
<b>Mountain valley</b>	Any low-lying land bordered by higher ground; especially an elongate, relatively large, gently sloping depression of the Earth's surface, commonly situated between two mountains or between ranges mountains, and often containing a stream with an outlet. It is usually developed by stream erosion, but may be formed by faulting. (Bates and Jackson, 1995)
<b>Noseslope</b>	(nose) The projecting end of a hill, spur, ridge, or mountain. (Bates and Jackson, 1995)
<b>Pinnacle</b>	(a) A tall slender tapering tower or spire-shaped pillar of rock, either isolated or at the summit of a mountain or hill; esp. a lofty peak. (b) A hill or mountain with a pointed summit. (Bates and Jackson, 1995)
<b>Pothole</b>	(a) A generic, imprecise term for any pot-shaped pit or hole; (b) A term applied to a small pit depression (1 to 15 meters deep, generally circular or elliptical, occurring in an outwash plain, a recessional moraine or till plain; (c) A small, rounded, steep-sided depression or pit in a coastal marsh, containing water at or below low-tide level; (d) A shallow depression, generally less than 10 acres in area, occurring between dunes on a prairie (as in Minnesota and the Dakotas), often containing an intermittent pond or marsh and serving as a nesting place for waterfowl. (e) A term used in Death Valley, Calif., for a circular opening, about a meter in diameter, filled with brine and lined with halite crystals; (f) vertical cave; (g) A smooth, bowl-shaped or cylindrical hollow, generally deeper than wide, formed in the rocky bed of a stream by the grinding action of a stone or stones, or of coarse sediment (sand, gravel, pebbles, boulders), whirled around and kept in motion by eddies or the force of the stream current in a given spot, as at a strong rapid or the foot of a waterfall. (Bates and Jackson, 1995)
<b>Ravine</b>	A small narrow deep depression, smaller than a gorge or a canyon but larger than a gully, usually carved by running water; esp. the narrow excavated channel of a mountain stream. (Bates and Jackson, 1995)
<b>Ridge</b>	(a) A general term for a long, narrow elevation of the Earth's surface, usually sharp-crested with steep sides, occurring either independently or as part of a larger mountain or hill; e.g. an extended upland between valleys. A ridge is generally less than 8 km long. (b) A term occasionally applied to a range of hills or mountains. (c) The top or upper part of a hill; a narrow, elongated crest of a hill or mountain. (Bates and Jackson, 1995)
<b>Rim</b>	The border, margin, edge, or face of a landform, such as the curved brim surrounding the top part of a crater or caldera; specif. the rimrock of a plateau or canyon. (Bates and Jackson, 1995)
<b>Riser</b>	The vertical or steeply sloping surface of one of a series of natural steplike landforms, such as those of a glacial stairway or of successive stream terraces. (Bates and Jackson, 1995)

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<b>Saddle</b>	(a) A low point in the crest line of a ridge, commonly on a divide between the heads of streams flowing in opposite directions. (b) A broad, flat gap or pass, sloping gently on both sides, and resembling a saddle in shape. (Bates and Jackson, 1995)
<b>Scarp</b>	(a) A line of cliffs produced by faulting or by erosion. The term is an abbreviated form of escarpment, and the two terms commonly have the same meaning, although "scarp" is more often applied to cliffs formed by faulting. See also: fault scarp; erosion scarp. (b) A relatively straight, clifflike face or slope of considerable linear extent, breaking the general continuity of the land by separating surfaces lying at different levels, as along the margin of a plateau or mesa. A scarp may be of any height. The term should not be used for a slope of highly irregular outline. See also: scarp slope. (c) beach scarp. (d) The main scarp or minor scarp of a landslide. (Bates and Jackson, 1995)
<b>Scour</b>	(a) The powerful and concentrated clearing and digging action of flowing air, water, or ice, esp. the downward erosion by stream water in sweeping away mud and silt on the outside curve of a bend, or during time of flood. (b) A place in a stream bed swept (scoured) by running water, generally leaving a gravel bottom. (Bates and Jackson, 1995)
<b>Seep</b>	An area, generally small, where water or oil percolates slowly to the land surface. For water, it may be considered as a syn. of seepage spring, but it is used by some for flows too small to be considered as springs. (Bates and Jackson, 1995)
<b>Shoal</b>	(a) A relatively shallow place in a stream, lake, sea, or other body of water; a shallows. (b) A submerged ridge, bank, or bar consisting of or covered by sand or other unconsolidated material, rising from the bed of a body of water to near the surface so as to constitute a danger to navigation; specif. an elevation, or an area of such elevations, at a depth of 10 fathoms (formerly 6) or less, composed of material other than rock or coral. It may be exposed at low water. Cf: reef. (c) A rocky area on the sea floor within soundings. (d) A growth of vegetation on the bottom of a deep lake, occurring at any depth. (Bates and Jackson, 1995)
<b>Step</b>	(a) A canyon bench greatly broadened by erosion, such as those characteristic of the high plateaus of the western U.S.; a steplike landform on a hillside or valley slope that is otherwise smoothly rising. (b) rock step. (Bates and Jackson, 1995)
<b>Swale</b>	(a) A slight depression, sometimes swampy, in the midst of generally level land. (b) A shallow depression in an undulating ground moraine due to uneven glacial deposition. (c) A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline. (d) A slight depression on a hillslope, which lies upslope from an organized stream channel. (Modified from Bates and Jackson, 1995)
<b>Talus</b>	Rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep, rocky slope. Also, the outward sloping and accumulated heap or mass of such loose broken rock, considered as a unit, and formed chiefly by gravitational falling, toppling, rolling, or sliding. (Bates and Jackson, 1995)
<b>Terracette</b>	A small ledge, bench, or steplike form, or a series of such forms, produced on the surface of a slumped soil mass along a steep grassy slope or hillside, ranging from several centimeters to 1.5 m in height and averaging a meter in width, and developed as a result of small landslides and subsequent backward tilting of the soil surface. (Bates and Jackson, 1995)
<b>Tread</b>	(a) The flat or gently sloping surface of one of a series of natural steplike landforms, such as those of a glacial stairway or of successive stream terraces; a bench level. Cf: riser. (b) A small flat. (Bates and Jackson, 1995)
<b>Trench</b>	(a) A long, straight, commonly U-shaped valley or depression between two mountain ranges, often occupied by two streams that drain in opposite directions. (b) A narrow, steep-sided canyon, gully, or other depression eroded by a stream. (c) Any long, narrow cut or excavation produced naturally in the Earth's surface by erosion or tectonic movements. Also, a similar feature produced artificially, such as a ditch. (Bates and Jackson, 1995)
<b>V-notch</b>	A small valley having a pronounced cross profile suggesting the form of the letter "V", characterized by steep sides, resulting from downcutting by a stream. (Modified from Bates and Jackson, 1995)
<b>Wash</b>	A term applied in the western U.S. (esp. in the arid and semiarid regions of the southwest) to the broad, gravelly, normally dry bed of an intermittent stream, often situated at the bottom of a canyon; it is occasionally filled by a torrent of water; or, A shallow body of water; esp. a shallow creek.

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	(Bates and Jackson, 1995)
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## **APPENDIX B - INVASIVE SPECIES INVENTORY FIELD FORMS**



## SITE AND SETTING FORM

### Management Area

<b>Allotment(RMU):</b>	<b>Pasture:</b>
<b>Key Area:</b>	<b>Area:</b>
<b>Watershed HUC #:</b>	
<b>HUC Name:</b>	

### Site Information

<b>Elevation Av:</b>	<b>Min Elevation:</b>	<b>Max Elevation:</b>	<b>UOM</b>
<b>Aspect-Azimuth:</b>		<b>Aspect-Cardinal Direction:</b>	
<b>Percent Slope:</b>		<b>Slope Position:</b>	

### Existing Vegetation Information

<b>Plant Community</b>			
<b>Class Set Name</b>		<b>Class Code:</b>	<b>Class Name</b>
<b>SAF Cover Type:</b>	<b>SRM Cover Type:</b>		<b>Dominant LifeForm:</b>
<b>Dominant Codominant Species</b>			
<b>Plant Code</b>	<b>Scientific Name</b>		<b>Ranking</b>

### Potential Vegetation Information

<b>Range Site/Eco Classification</b>	
<b>Class Code:</b>	<b>Class Name:</b>
<b>Habitat Type Code:</b>	<b>Habitat Type Name:</b>
<b>HT Phase Code:</b>	<b>HT Phase Name:</b>
<b>Plant Association Code:</b>	<b>Plant Association Name:</b>
<b>Seral Stage:</b>	<b>Ecological Status (%):</b>
<b>Ecological Map Unit Code:</b>	
<b>Ecological Map Unit Name:</b>	
<b>Ecological Type Code:</b>	
<b>Ecological Type Name:</b>	

### Soil/Geo Climate Information

<b>Soil Name:</b>	<b>Class Level:</b>
<b>Soil Texture:</b>	<b>Common Landform:</b>
<b>Primary Lithology:</b>	
<b>Secondary Lithology:</b>	
<b>Mean Annual Precipitation</b>	<i>inches</i>

**Reference**

**Narrative** (detailed description of location, direction to site and map location if applicable. Include information in locating the starting point for the traverse leg and other important description information.


Traverse information for start point to sample point.

<b>Azimuth (degrees):</b>	<b>Distance:</b>
<b>Distance UOM:</b>	

**Photo/Image**

<b>Aerial Photo Information</b>	
<b>Photo Label:</b>	<b>Aerial Photo Set:</b>
<b>Photo Number:</b>	<b>Flight Line Code:</b>
<b>Photo Date\Time (mm/dd/yyyy hh:mm):</b>	
<b>Photo Information</b>	
<b>Photo Number:</b>	<b>Film Type:</b>
<b>File Name:</b>	<b>File Directory:</b>

**Comments**


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**Geopolitical Location**

<b>Region:</b>	<b>National Forest/Grassland:</b>	<b>District:</b>
<b>State:</b>	<b>County:</b>	
<b>Sample Area Size:</b>	<b>Unit of Measure:</b>	

**Location Information**

<b>QUADS</b>	
<b>USGS Quad Number:</b>	<b>USGS Quad Name:</b>
<b>Forest Quad Number:</b>	<b>Forest Quad Name:</b>

<b>Legal Description:</b>				
<b>Meridian:</b>	<b>Township/Direction Range/Direction:</b>			
<b>SEC:</b>	<b>Q SEC:</b>	<b>QQ SEC:</b>	<b>QQQ SEC:</b>	<b>QQQQ SEC:</b>
<b>Latitude and Longitude</b>				
<b>Geodetic Datum:</b>				
<b>Lat dms:</b>	<b>Degrees:</b>	<b>N</b>	<b>Minutes:</b>	<b>Seconds:</b>
<b>Long dms:</b>	<b>Degrees:</b>	<b>W</b>	<b>Minutes:</b>	<b>Seconds:</b>
<b>GPS Datum:</b>				
<b>Latitude DDegrees:</b>			<b>Longitude DDegrees:</b>	
<b>UTM Datum:</b>			<b>UTM Zone:</b>	
<b>Easting:</b>			<b>Northing:</b>	

<p><b>Metes and Bounds:</b> (narrative) Metes are the bearing and distance to get to someplace or to return to the place of origin. Bounds are the written directions going to something or someplace.</p> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
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